SCIENCE AND INDUSTRY.

TECHNICAL EDUCATION.

The Value of Science in its Application to the Useful Purposes of Life.

At a recent meeting of the British Association for the Advancement of Science, Sir LYON PLAYFAIR, the president, delivered an address in which occurs the following. It is, in our judgment, most admirable, and we trust will set to thinking some large-hearted man or men, blessed with much of this world's goods, in the direction of the foundation of a school of technology at Richmond. It would be a monument that would never perish:

In the popular mind the value of science is measured by its applications to the useful purposes of life. The rapid development of industry in modern days depends on the applications of scientific knowledge, while its slower growth in former times was due to experiments being made by trial and error in order to gratify the needs of man. Then an experiment was less a questioning of nature than an exercise on the mind of the experimentalist, for a true questioning of nature only arises when intellectual conceptions of the causes of phenomena attach themselves to ascertained facts as well as to their natural environments. When the questioning of nature by intelligent experiment has raised a system of science, then those men who desire to apply it to industrial inventions proceed by the same methods to make rapid progress in the arts. They also must have means to compel nature to reveal her secrets. Æneas succeeded in his great enterprise by plucking a golden branch from the tree of science. It is by carrying such a golden branch from the tree of science that inventors are able to advance the arts. When we examine the order of progress in the arts, even before they are illumined by science, their improvements seem to be the resultants of three conditions: 1. The substitution of natural forces for brute animal power, as when Hercules used the waters of the Alpheus to cleanse the Augean stables; or when a Kamchadal of Eastern Asia, who has been three years hollowing out a canoe, finds that he can do it in a few hours by fire. 2. The economy of time, as when a calendering machine produces the same gloss to miles of calico that an African savage gives to a few inches by rubbing it with the shell of a snail; or the economy of production, as when steel pens, sold when first introduced at one shilling apiece, are now sold at a penny per dozen; or when steel rails, lately costing £45 per ton, can now be sold at £5. 3. Methods of utilizing waste products, or of endowing them with properties which render them of increased value to industry, as when waste scrap-iron and the galls on the oak are converted into ink; or the badly-smelling waste of gas-works is transformed into fragrant essences, brilliant dyes, and fertilizing manure; or when the effete matter of animals or old bones is changed into lucifer matches. All three results are often combined when a single end is obtained; at all events economy of time and production invariably follows when natural forces substitute brute animal force. In industrial progress the sweat of the brow is lessened by the conceptions of the brain. How exultant is the old Greek poet, Antipater, when women are relieved of the drudgery of turning the grindstones for the daily supply of corn! "Woman! you have hitherto had to grind corn, let your arms rest for the future. It is no longer for you that the birds announce by their songs the dawn of the morning. Ceres has ordered the water-nymphs to move the heavy millstones and perform your labor." Penelope had twelve slaves to grind corn for her small household. During the most prosperous time of Athens it was estimated that there were twenty slaves to each free citizen. Slaves are mere machines, and machines neither invent nor discover. The bondmen of the Jews, the helots of Sparta, the captive slaves of Rome, the serfs of Europe, and uneducated laborers of the present day, who are the slaves of ignorance, have added nothing to human progress. But as natural forces substitute and become cheaper than slave labor, liberty follows advancing civilization. Machines require educated superintendence. One shoe-factory in Boston by its machines does the work of 30,000 shoemakers in Paris, who have still to go through the weary drudgery of mechanical labor. The steam-power of the world during the last twenty years has risen from 11,500,000 to 29,000,000 horse-power, or 152 per cent. The coal, which has hitherto been the chief source of power, probably represents the product of five or six million years during which the sun shone upon the plants of the carboniferous period, and stored up its energy in this convenient form. But we are using this conserved force wastefully and prodigally; and although horse-power in steam-engines has so largely increased since 1864, two men only now produce what three men did at that date. It is only three hundred years since we became a manufacturing country. According to Professor Dewar, in less than two hundred years more the coal of this country will be wholly exhausted, and in half that time will be difficult to procure. Our not very distant descendants will have to face the problem, What will be the condition of England without coal? The answer to that question depends upon the intellectual development of the nation at that time. The value of the intellectual factor of production is continually increasing, while the values of raw material and fuel are lessening factors. It may be that when the dreaded time of exhausted fuel has arrived its importation from other coal-fields, such as those of New South Wales, will be so easy and cheap that the increased technical education of our operatives may largely overbalance the disadvantages of increased cost in fuel. But this supposes that future governments in England will have more enlightened views as to the value of science than past governments have possessed. Industrial applications are but the overflowings of science welling over from the fulness of its measure. Few would ask now, as was constantly done a few years ago, "What is the use of an abstract discovery in science?" Faraday once answered this question by another—"What is the use of a baby?" Yet round that baby centre all the hopes and sentiments of his parents, and even the interests of the State, which interferes in its upbringing so as to insure its being a capable citizen. The processes of mind which produce a discovery of an invention are rarely associated in the same person, for while the discoverer seeks to explain causes and the relations of phenomena the inventor aims at producing new effects, or at least of obtaining them in a novel and efficient way. In this the inventor may sometimes succeed without much knowledge of science, though his labors are infinitely more productive when he understands the causes of the effects which he desires to produce. A nation in its industrial progress, when the competition of the world is keen, cannot stand still. Three conditions only are possible for it. It may go forward, retrograde, or perish. Its extinction as a great nation follows its neglect of higher education, for, as described in the proverb of Solomon, "They that hate instruction love death." In sociology, as in biology, there are three states—the first of balance, when things grow neither better nor worse; the second, that of elaboration or evolution, as we see it when animals adapt themselves to their environments; and third, that of degeneration, when they rapidly lose the ground they have made. For a nation, a state of balance is only possible in the early stage of its existence, but it is impossible when its environments are constantly changing. The possession of the raw materials of industry and the existence of a surplus population are important factors for the growth of manufactures in the early history of a nation, but afterwards they are bound up with another factor—the application of intellect to their development. Science has in the last hundred years altered altogether the old conditions of industrial competition. She has taught the rigid metals to convey and record our thoughts even to the most distant lands, and, within less limits, to reproduce our speech. This marvellous application of electricity has diminished the cares and responsibilities of governments, while it has at the same time altered the whole practice of commerce. To England steam and electricity have been of incalculable advantage. The ocean, which once made the country insular and isolated, is now the very life-blood of England and of the greater England beyond the seas. As in the human body the blood bathes all its parts, and through its travelling corpuscles carries force to all its members, so in the body-politic of England and its pelagic extensions, steam has become the circulatory and electricity the nervous system. The colonies, being young countries, value their raw materials as their chief sources of wealth. When they become older they will discover it is not in these but in the culture of scientific intellect that their future prosperity depends. Older nations recognize this as the law of progress more than we do, or, as Jules Simon tersely puts it, "That nation which most educates her people will become the greatest nation, if not to-day, certainly to-morrow." Higher education is the condition of higher prosperity, and the nation which neglects to develop the intellectual factor of production must degenerate, for it cannot stand still. If we felt compelled to adopt the test of science given by Comte, that its value must be measured by fecundity, it might be prudent to claim industrial inventions as the immediate fruit of the tree of science, though only fruit which the prolific tree has shed. But the test is untrue in the sense indicated, or, rather, the fruit, according to the simile of Bacon, is like the golden apples which Aphrodite gave to the suitor of Atalanta, who lagged in his course by stooping to pick them up, and so lost the race. The true cultivators of the tree of science must seek their own reward by seeing it flourish, and let others devote their attention to the possible practical advantages which may result from their labors. There is, however, one intimate connection between science and industry which I hope will be more intimate as scientific education becomes more prevalent in our schools and universities. Abstract science depends on the support of men of leisure, either themselves possessing or having provided for them the means of living without entering into the pursuits of active industry. The pursuit of science requires a superfluity of wealth in a community beyond the needs of ordinary life. Such superfluity is also necessary for art, though a picture or a statue is a salable commodity, while an abstract discovery in science has no immediate or, as regards the discover, proximate commercial value. If our universities and schools created that love of science which a broad education would surely inspire, our men of riches and leisure who advance the boundaries of scientific knowledge could not be counted on the fingers, as they now are, when we think of Boyle, Cavendish, Napier, Lyell, Murchison, and Darwin, but would be as numerous as our statesmen and orators. Statesmen, without a following of the people who share their views and back their work, would be feeble indeed. But while England has never lacked leaders in science, they have too few followers to risk a rapid march. We might create an army to support our generals in science, as Germany has done, and as France is now doing, if education in this country would only mould itself to the needs of a scientific age. It is with this feeling that Horace Mann wrote: "The action of the mind is like the action of fire; one billet of wood will hardly burn alone, though as dry as the sun and northwest wind can make it, and though placed in a current of air; ten such billets will burn well together, but a hundred will create a heat fifty times as intense as ten—will make a current of air to fan their own flame and consume even greenness itself."

The Huguenot Emigration to Virginia.

To the Editor of the Dispatch:

The Virginia Historical Society would announce that it will issue early in 1886, as its annual publication, "Documents Relating to the Huguenot Emigration to Virginia," to form Volume V. of its new series of collections (edited by the subscriber), and to be uniform with the preceding volumes of the "Spotswood Letters" and the "Dinwiddie Papers." The documents to compose the prospective volume are of the highest importance and interest, a majority of them never having been printed in any form. It is desired that they shall be amply elucidated by introduction and definite foot-notes to the text, historical and biographical, and, if feasible, by genealogical addenda. Among the more familiar names appearing in the documents may be mentioned the following: Amis, Apperson, Ayer, Allegre, Ammonet, Bernard, Bondurant, Brian, Cury, Chastain, Deneille, Duval, Dupre, Dupuy (or DuPuy), Esly, Edmon, Elson, Fontaine, Flournoy, Faure, Godse, Gore, Gillam, Guerrant, Hampton (or Hamton), Jourdan, Kempe, Leroy, LeFebre, Leverre, Lesueur, LeGrand, Landon, Loucadou, Lacy, Mallet, Michel, Morriset, Maupain, Marye, Morrel, Martain, Orringe, Pasteur, Pero, Peronet, Parrat, Pankey, Popham, Rich, Roberd, Reno, Sumtur, Soullie, Salle, Soblet, Trabu, Taller, Trent.

The contribution of data, however meagre, towards some notice of these names, or of any others of like origin and connection, or of any document (or copy) relating to the Huguenot settlement in Virginia, is earnestly solicited from those interested.

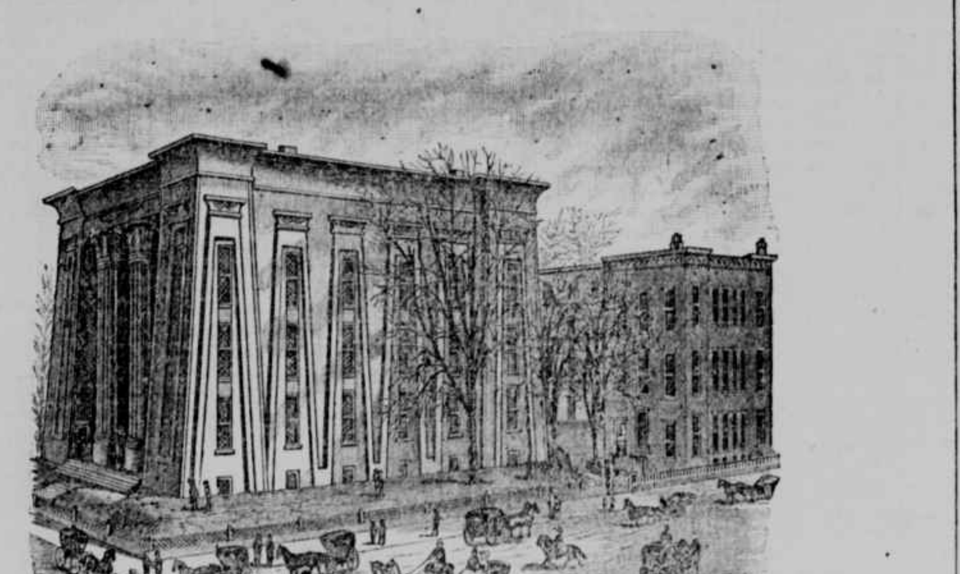
The publications of the Society have been in limited editions for distribution among its members and kindred institutions. The annual subscription to the Society is $5—no entrance fee; life-membership, $50.

Correspondence is requested with those interested in the objects and welfare of the Society, and the names, also, of others who may be addressed in such behalf. R. A. BROCK,
Corresponding Secretary of the Virginia Historical Society.

VIRGINIA EDUCATION.

THE MEDICAL COLLEGE.

Its Early History—Professors of the Past—Work It Has Done and is Now Doing.



The recent opening of the forty-eighth session of the Medical College of Richmond has awakened an interest in its present condition and past history.

The conception of the college seems to have occurred to Dr. Augustus L. Warner, the gifted professor of surgery in the University of Virginia—gifted not only with high capacity as a man of thought and a teacher, but as a skilful and daring practical surgeon. He recognized in the city of Richmond a most eligible point in the southern States for the location of a medical college; a point at which medicine could be taught practically and completely and under influences most favorable. There was then one, and possibly more than one, city in the southern States larger, but the climate of Richmond, its rapid growth, high social culture, and general educational advantages impressed him as giving it a peculiar fitness for the location of a medical school. Having communicated his views to Dr. John Cullen, probably the most brilliant practitioner in the city at that time, sparkling in his Irish wit, fluent in his utterance, and at the same time sagacious in his judgment, altogether a man endowed with remarkable powers as an instructor, as his subsequent career proved. Professor Warner was heartily seconded by this gentleman in his plans.

The establishment of the college was the issue of these deliberations, with the following gentlemen arranged as a faculty: John Cullen, M. D., professor of practice of medicine; Thomas Johnson, M. D., professor of anatomy and physiology; R. L. Bohannan, M. D.; professor of obstetrics and diseases of women and children; Socrates Maupin, M. D., professor of chemistry and pharmacy; Lewis W. Chamberlayne, M. D., professor of materia medica and therapeutics; Augustus L. Warner, M. D., professor of surgery and surgical anatomy; Robert Munford, M. D., demonstrator of anatomy; Augustus L. Warner, M. D., dean of the faculty.

Dr. Johnson was a gentleman of superior intellect and attainments, and was well informed on the subjects of the chair for which he was selected. He was a near kinsman of Chapman Johnson, then one of the most distinguished lawyers in the State.

Dr. Bohannan was well fitted for the duties of his chair, having had a larger practical experience in the department of work than any of his predecessors or contemporaries in this city.

Dr. Socrates Maupin was a gentleman of liberal and accurate education. He was probably at that time one of the ablest chemists of the southern country, who, after having filled that position with marked ability in this institution and a portion of the time as the successor of Professor Warner as dean of the faculty, was elected to the University of Virginia to supply the vacancy occasioned by the resignation of Dr. Robert E. Rogers. This position he filled with eminent success to the close of his life, and for many years previous to his death was the chairman of the faculty of that institution.

Dr. Lewis W. Chamberlayne, the father of the lamented J. Hampden Chamberlayne, was a cultivated gentleman and popular practitioner, with strong convictions and a forcible delivery. He was a successful teacher.

The eminent qualifications of Professors Cullen and Warner and the distinguishing features of their minds have already been referred to.

One difficulty, however, met the enterprise at the start. There was a profound objection existing at that time in the State, amounting even to an intense prejudice, against conferring certain chartered privileges. So great was this opposition that corporations of any kind were rarely allowed, and even the Episcopal Theological Seminary at Alexandria and the Union Theological Seminary at Hampden-Sidney were unable to procure charters under which to conduct those institutions. Under such circumstances the privilege was secured from the trustees of Hampden-Sidney to act under its charter, on the condition that $500 was to be paid annually for the privilege.

With the faculty organized as already indicated, the college commenced operations in the fall of 1838, and held its first commencement on the 4th of April, 1839, having had a class of forty-six students and, at the termination of the session, fourteen graduates—all of these graduates probably having attended previous courses of lectures at other colleges.

The first catalogue of the college was introduced by the following paragraphs:

"In issuing their first catalogue the trustees of Hampden-Sidney College congratulate the citizens of Virginia and all who are well-wishers to the prosperity and independence of the South that the efforts which have been made in the last year to establish in the metropolis of Virginia a medical school adequate to her wants and capable at once of contrasting favorably in all the appliances for instruction with the oldest medical institutions of the country have been crowned with success.

"This institution commends itself to the patronage of the South not merely from its being one of her own institutions, but that it affords every facility for medical instruction which can be obtained elsewhere. After the experience of a year the trustees can speak with confidence of the advantages here afforded the student, and, by contrasting them with those of similar schools, feel assured that this will not suffer by the comparison.

"Located in the centre of the State, and accessible to the whole southern country, and distinguished for the salubrity of its climate, Richmond must be regarded as the most favorable position in the South for a medical school, for while the southern student escapes the rigors of the northern winter, he is yet enabled to pursue his anatomical studies to advantage."

The college had a successful progress with an average class of fifty or sixty students from that time up to the period of the war, the efforts of the faculty having been directed then, as they still are, to afford thoroughness of medical instruction rather than to secure a large attendance of students.

Nearly all of the original faculty labored in the institution for a score of years, or for a period approaching it, and all, with two exceptions, until they were removed by death.

Professor Johnson resigned on account of ill-health, and Professor Maupin resigned, as already stated, to accept a position in the University of Virginia. Dr. Johnson's place, which made the first vacancy in the faculty, was filled by the election of Dr. Jeffries Wyman, of Massachusetts, one of the most profound scientists in the country, who in 1847 was elected professor of anatomy in Harvard University. The vacancy occasioned by the resignation of Professor Wyman was supplied by the election of Dr. Carter P. Johnson, who, although young, was a gentleman of high attainments, both academic and professional—of exalted character, and gave promise of the most eminent success as a professor and practitioner. In the year 1854 he perished in the wreck of the ill-fated steamer Arctic, on his return from Europe, where he had been to secure equipments for his chair.

The instructions of the college were first conducted in what was formerly the Union Hotel, situated at the corner of Nineteenth and Main streets, which was suitably fitted up for the work. The faculty preferred, however, to have a building specially constructed for the purpose of medical instruction and located more suitably. To facilitate that design the city of Richmond made an appropriation of $6,000 to purchase the lot at the corner of Marshall and College streets, upon which the present college building is situated. This position was then, as it still is, in nearly the geographical centre of the city, and otherwise admirably adapted for the location of such an institution. On this lot the faculty erected in 1846 the building which is now standing. It is in the Egyptian style of architecture, and in point of beauty and refined taste is perhaps not surpassed by any building in the State. Its interior adaptation to the wants of such an institution is proportionately advantageous.

A misunderstanding having occurred between the trustees of Hampden-Sidney College and the faculty of the Medical College, the latter made application to the Legislature for an independent charter, which in February, 1854, was readily granted, and the present system of organization established, with a board of visitors consisting of nineteen members, the original members having been designated by the Legislature, with a provision that vacancies should be filled by the Governor.

As vacancies occurred in the faculty the Board of Visitors filled them. The following professors, after having adorned the chairs to which they were respectively attached with an ability probably not surpassed by the professors of any medical school, have passed away: Professor James H. Conway, Professor Charles Bell Gibson, Professor Beverley R. Wellford, Professor David H. Tucker, Professor Arthur E. Petticolas, Professor Robert J. S. Peebles, Professor Levin S. Joynes, Professor Robert B. Coleman, and now the college and the public mourn over the new-made grave of Emeritus Professor Francis D. Cunningham, who honored every connection which he held with the college—first that of student, then that of professor, and, when failing health had compelled his resignation, that of an ever-loyal son and friend. Of the successors who survive it is unnecessary to speak, since they are well known to the present generation either personally or by reputation.

Upon the election of Mr. Lincoln as President of the United States, and the foreshadowing of the inevitable disruption of the Union, the medical students from the southern States who were then in the northern colleges, fired with the common sympathies of their fathers at home, almost to a man seceded from those colleges, and nearly all of them came in a body to join the classes of the Medical College of Virginia. This event was among the most notable of the history of those stirring times, and awakened an intense interest among the people of this city and State.

The City Council made an appropriation of $5,000 to receive and entertain the students, and sent a committee of its members, in conjunction with a committee of the faculty, to meet these returning sons of the South at Aquia creek, the then northern terminus of the Richmond, Fredericksburg and Potomac railroad, where they then stepped from the steamboats upon Virginia soil. The entertainment was given at the old Columbian Hotel, subsequently burned at the evacuation. At this entertainment 2,500 persons were seated at the tables, including the Governor, the judges of the Court of Appeals, the members of the Legislature, and a large number of the most distinguished citizens of the State. On the next day the Legislature made an appropriation of $30,000 to erect upon the college-grounds a building suitable for hospital purposes to afford additional means of clinical instruction.

During the war the Medical College of Virginia was the only college in the southern States which continued its courses of medical instruction, maintaining then a continuous session, and its graduates furnished nearly all the recruits to the medical staff of the Confederate army.

The close of the war brought about a sad change in the condition of the country. The whole southern people were impoverished, and probably not one in a thousand of those who formerly were in affluence—and many with fortunes which were even princely—were then able to afford their children collegiate educations. The struggle then was for existence. As a result here, as in other institutions of learning in the southern States, very many of which were discontinued, there was a rapid decline of the classes, and but few even of those who received the instruction of the college were able to pay for it. Five years after the termination of the war the class was reduced to seventeen, and for many years afterwards, as a consequence of the impoverishment of the country, the classes were not much larger. So the labors of the faculty, beneficent as they were to the public, were without pecuniary compensation to themselves. This did not, however, deter them from faithfully discharging their duties to the young men who had sought their instructions, and worthily fitting them for the work of their lives.

The classes of the past four years, however, have steadily increased, the average for the past two years having been eighty-two.

The faculty, however, have not been content with simply an increase in the number of students, but has proportionately increased its advantages for medical instruction. It has extended the length of its sessions, it has augmented its resources for lecture-room illustration, and greatly increased its advantages for clinical observation.

As a result of the efficiency of its course of instruction, it is a matter of congratulation to know that its students uniformly, now as in the past, sustain the reputation of the school by their success before the examining boards of the army and navy and the examining boards of the several States.

The success of its graduates as practitioners has been but little less uniform.

In all respects the college is doing well, and has an auspicious future. The attendance of students is now larger than at the corresponding period of any preceding year.

Scientific Notes.

Dr. J. A. Fleming, of the Edison & Swan Electric-Light Company, has been appointed Professor of Electrical Engineering by the Council of University College, London.

Mr. R. F. Friswell, in a paper read before the Chemical Society, London, says that the results of his personal experience with toughened glass, during a period of eleven months, has caused him to regard that substance, when formed into laboratory utensils, as a complete failure.

A permanent commission has been appointed in Austria for investigating the causes of explosions in mines. Among the subjects to be dealt with are safety-lamps, coal-dust explosions, meteorological observations, the employment of gunpowder for blasting, and ventilation of mines.

Dr. Albert Rosenberg, of Berlin, has found in a solution of methol a useful substitute for expensive cocaine in cases requiring local anesthesia of the mucous membrane of the nose, pharynx, larynx, &c. It is said to be more transitory in effect than cocaine, and, on repeating the application, to give evidence of cumulative action.

There is a qualitative test for butter, so simple that any housewife can put it into successful practice. A clean piece of white paper is smeared with a little of the suspected butter. The paper is then rolled up and set on fire. If the butter is pure the smell of the burning paper is rather pleasant; but the odor is distinctly tallowy if the "butter" is made up wholly or in part of animal fats.

Magnesite has been introduced as a new substance for lining furnaces. Its approximate composition is carbonaceous magnesia, 90.30 to 97.32 per cent.; carbonaceous limestone, 0.05 to 0.61 per cent.; argillaceous earth, 1.40 per cent.; iron oxide, 4.49 per cent.; insoluble residuum, 3.73 per cent. Magnesite, after having been burned, is chiefly employed in the form of magnesia stone for furnace bottoms.

Professor Joules Arnould contends in the *Journal de Pharmacie et de Chimie* that the only objectionable part of the process of the manufacture of ultramarine, from a sanitary point of view, is the calcination of the materials, which gives off large quantities of sulphurous acid that ought to be absorbed by suitable means and prevented from doing the mischief it does when liberated in abundance into the atmosphere.

Dr. Bonavia, of the Lucknow Horticultural Gardens, has but little faith in the statements as to the suitability and value of the *Eucalyptus globulus* in swampy and marshy districts. The results of his experiments with the tree confirm the unfavorable results that have also been obtained with it in Italy, and he is surprised that it should ever have been deemed fitted to discharge the efficacious and salutary functions that have been so universally claimed in its behalf.

An appliance for drying and superheating steam has been devised by multitubular boilers by Max Gehre, of Hanover. As superheaters in the fire-box act unequally, and are liable to great strain, the Gehre apparatus is placed in the smoke-box. The apparatus itself is traversed by tubes forming a continuation of those in the boiler, but of rather larger diameter. The steam is thus superheated by contact with the sides of the tubes and of the chest, which are continuously heated by the products of combustion.

A great many "land-locked" salmon were lately placed in the river Thames by the Thames Angling Preservation Association, in the presence of several gentlemen who have a deep interest in the development of fresh-water fisheries. This species of salmon is considered to be admirably adapted for a life in the Thames, as it is not a migratory one. Fish that quit the waters of that river for the sea are not likely to return to it ever again, as the lower portion of the Thames is little better than a huge sewer.

HOW TORNADOES FORM.

MYSTERIES OF THE CLOUD.

Facts Brought Out by an Investigation of Eight Years—A Rotary Motion of 2,000 Miles an Hour.

A Washington special says: Lieutenant John P. Finley, of the signal corps, has been studying the phenomena of tornadoes for the past eight years. Tornadoes are now so well understood that it is believed that trustworthy warning can soon be sent out to the localities threatened. In fact, experimental predictions have been made for a year, with good result.

According to Lieutenant Finley, tornadoes have distinctly marked characteristics and are by no means to be confounded with hurricanes, "blizzards," cyclones, or northeasters. Their tracks are never more than a few hundred yards wide. Their rotary motion, which is greatest towards the centre, sometimes reaches the enormous rate of 2,000 miles an hour, while their forward movement, always from southwest to northwest, ordinarily does not exceed forty or fifty miles. They are usually unaccompanied by electrical disturbances and are believed to be uninfluenced by electrical conditions, though violent thunder-storms sometimes follow them a few miles away.

THE HOME OF THE TORNADO.

There is a distinct and curious relationship between the tornado and the general storm-centre, which is always apparent in their uniform relative positions, the tornado always occurring southeastwardly from the centre of low barometic pressure and at a distance of from one to six hundred miles. The shape of the general storm-centre, the direction in which its lowest barometer lies, and the appearance of the upper and lower clouds enter as minor elements into the problem out of which the weather experts hope to work a complete system of tornado warnings. The visits of the tornado are commonly between the hours of 2 and 6 o'clock in the afternoon. Its home is an area which includes the whole of Iowa, all of Missouri except the southeastern corner, the northwestern corner of Arkansas, the northeastern part of the Indian Territory, Eastern Kansas, Eastern Nebraska, Southern Minnesota, Southern Wisconsin, and Western Illinois. Here its season extends from April to August inclusive. It is also a frequent visitor to two other regions. These are, first, a strip along the Gulf and South Atlantic coasts, which takes in the central portions of Alabama, Georgia, and South Carolina, with termini in Mississippi and North Carolina, over which its devastations are confined to the months of January, February, and March. The second includes a portion of Southern and Central Ohio, a large portion of Pennsylvania, a small area in Maryland, a strip across New York, and a corner of each of Massachusetts and Connecticut, where it is in season only during August and September.

HOW THE TORNADO FORMS.

The conditions which are favorable to the creation of tornadoes are present when a cool, dry current of air meets a warm, moist current, bringing wide extremes both of temperature and humidity into close proximity. The cool, dry currents come from the north, but such as flow over the great lakes pick up in their course both moisture and heat, and their destructive forces are thus neutralized. Those blowing from the far northwest, down over the dry plains of Manitoba and Dakota, carry something of their Arctic characteristics far South, and if in their course they meet one of the heat- and vapor-laden breezes coming up from the Gulf the war of the elements begins at the point of contact. The storm always has its birth in the upper air, its first visible manifestation being the ominous funnel-shaped cloud, whose pendant trunk is in form not unlike that of an elephant. Within it the furies are confined, and when and where its point touches the earth the path of destruction begins. When the isotherm of the morning signal-map shows the advancing columns of air, with their wide contrasts of temperature, in proximity; when the general storm-centre is in that relative position which seems necessary to the exercise of its mysterious influence; when the pressure is low toward the east, disclosing a vacuum into which the deflected currents may advance without obstruction—when all these conditions combine it should become but a simple problem for the experts to determine with reasonable probability from the wind velocities whether the threatening line of contact will have advanced to or beyond the tornado's accustomed haunts by the time of day when the powers of mischief shall be loosed.

THE UNKNOWN QUANTITIES.

The chief remaining unknown quantities in the problem consist of data of time and place, a great store of which is already in hand and only awaits digestion and tabulation, while 1,500 special tornado observers are gathering additional facts respecting current storms and from all available sources the stories of long past tornadoes, known to the earlier settlers as wind-falls. Thus, while a host of interesting scientific questions respecting the origin of tornadoes, the laws which govern them, and their relationship to other meteorological phenomena remain to be answered, the more practical questions as to when and where they are likely to appear seem to be advancing rapidly toward solution.

The interests which are subject to disaster from tornadoes are alive to the importance of the work in progress. Intending purchasers of farms apply to the Signal Office for information respecting the liability of their selected locality to disaster. To such are sent the records of the past as far as they are known. Whenever Lieutenant Finley travels in pursuit of his studies farmers and villagers press for information. To these he says that nothing raised by the hand of man above the surface of the earth can withstand the shock of the tornado. He advises them to seek their dug-outs on the appearance of the portentous signs of disaster and there await the passage of the storm. For their property he advises insurance, so that the losses of the individual may be shared by his fortunate neighbors.

Working the Automaton Chess-Player.

[The Cornhill Magazine.]

When Maelzel was in Baltimore with his automaton chess-player, by a curious accident a discovery was made of the fact that some one was concealed in the automaton. The affair happened thiswise: One day two lads mounted upon the roof of a shed commanding a view of the back room to which the Turk retired when the exhibition was over. On this occasion Maelzel, directly the audience had dispersed, rolled the android behind the curtain. Intent only upon relieving his ally from his irksome confinement—for the heat in that southern city is in summer wellnigh intolerable—Maelzel stepped to the window, threw the shutters wide open, and then, returning to the automaton, he removed the top of the chest. From this hiding-place there emerged, in full sight of the youths, the figure of a man in his shirt-sleeves, whom there was no difficulty in recognizing as Schlumberger. To be the depositaries of so important a secret was a burden under which their strength gave way; and the story, confided in the first instance to their respective parents, soon spread and reached the public. But the tale obtained very little credence. The general opinion was that a secret which had baffled for upward of half a century the best mechanicians and mathematicians of the age was something altogether too deep to be penetrated by a couple of school-boys. This danger, therefore, Maelzel safely tided over; but not long afterward a more serious one presented itself. One day a young man of the name of Walker called upon him in New York and said: "Mr. Maelzel, would you like to buy another chess-player? I have one ready made for you." Surely enough, this was the case. Maelzel saw the automaton in question, and made the inventor an offer of one thousand dollars for it; for although the mechanism of the machine was very different from that of the original, there seemed to be some likelihood of its competing injuriously with his own. The offer, however, was declined by the owner of the new android, who proceeded to exhibit it on his own account. In this he was unsuccessful; for there existed in the community a deeply-rooted prejudice in favor of the historical invention of Von Kempelen, which gave Maelzel a vantage ground from which no efforts of rival exhibitors could easily have driven him.

The Old Man.

[Two Years in the Jungle—Hornaday.]

Because of his bald and shiny head, his solemn, wrinkled, and melancholy visage, his air of profound gravity and senatorial wisdom, we got to calling him the Old Man, and forgot to give him any Christian name. A thin growth of brick-red hair grew straight up the back of his head and over the crown, making in certain lights a perfect halo around his bald, brown pate, reminding one rather forcibly of certain pictures by the old masters. I measured him for the first time on October 15th, in spite of his vigorous opposition, and found that his height was 21¼ inches, extent of arms 34½ inches, and his weight 10¼ pounds. His body was short and thick, and, like all ourangs, his arms were so long and his legs so short that by stooping forward a little his hands easily touched the ground. In walking he invariably went on all fours, placing the back of the fingers and ball of the thumb, instead of the palm, upon the ground, and he also turned his toes under. His gait on the ground was very much like that of a man going on crutches with both feet injured alike. On the ground he moved slowly, seeming quite out of his element, but his feats in climbing and his performances on the slack-rope were highly entertaining. He was fresh from the jungle when brought to me, but I soon convinced him that my intentions were honorable, and slowly gained his confidence. For three or four days he would not allow me to hold him in my arms unless I would let him grasp some firm object with at least one hand. The action plainly showed that he feared I would play a trick on him by letting him fall. Presently, however, I hit upon a plan which conquered his suspicion. I made him climb up to my shoulder to get the bananas, of which he was very fond, and after that a banana held at arm's length above my head would start him climbing my body as if it were a tree until the tempting bait was reached. He soon became very fond of being held in my arms, and when I grew tired of holding him he would grasp the folds of my flannel shirt and hold himself—quite an improvement upon the puny helplessness of human infants. Next to eating seven bananas at once, his greatest delight was in sitting lazily in my lap while I sat reading, writing, or even eating, sprawling out his legs and arms, catching hold of my book or my pen-holder, or pulling at the table-cloth. Once while holding him in my lap at dinner he suddenly made a pass at the roast duck which lay before me, and had his teeth in it before I could recover from my surprise. On one occasion when I sat eating he leisurely climbed up the back of my chair, squatted on the topmost round, leaned lazily forward against me, and rested his chin comfortably on my shoulder. And there he sat all through the meal, watching the performance with the air of a connoisseur.

In the Land of the Kazh.

[Professor Vambery.]

The Afghan women, of whom we saw perhaps a dozen, wore no bonnets, but simply a long veil of gauzy stuff. Look at them in the right way and they are pretty. Their countenances have a Jewish cast, but they are not brunettes. Their skin is pale, strikingly so, and they wear their hair tied over a ball, so as to make them look more than naturally white. They walk remarkably well, and in the management of their veils display much grace and elegance. Of the men I may as well say that they are not unlike what a cross between a Hindoo and a Persian would be. Athletic, fair, and well-bearded, they have aquiline faces, with the foreheads shaved, and the hair on the sides hanging in curls, that fall over the shoulders in a picturesque, shaggy, mane-like way. Their carriage is full of resolution and pride, and from one corner of the country to another you cannot but remark that they remind you of bantam roosters. And they are like them, too—turbulent, vain, brutal, quarrelsome, liking nothing better than the practice of cruel sport. The Kazh, or chief tribesman of Cois, was as perfect a game-bird as I ever saw.